PROCEEDINGS OF THE ROYAL SOCIETY B

Proc. R. Soc. B (2008) **275**, 2419–2421
doi:10.1098/rspb.2008.0677
Published online 29 July 2008

Comment

Integration versus apartheid in post-Roman Britain: a response to Pattison

In this issue, Pattison (2008) questions whether it is necessary to assume an apartheid-like social structure in Early Anglo-Saxon England (Thomas *et al.* 2006) in order to account for the apparent discrepancy between archaeological estimates of the scale of Anglo-Saxon migration into post-Roman Britain (Härke 2002; Hills 2003) and Y-chromosome-based estimates of the contribution of Germanic settlers to the modern English gene pool (Weale *et al.* 2002; Capelli *et al.* 2003). He is mainly concerned with a model mathematically explored by Thomas *et al.* (2006) but first proposed on historical arguments by Woolf (2004, 2007; but also see Charles-Edwards 1995; Härke 1998). This model assumes that the people of indigenous ethnicity were at an economic and legal disadvantage compared with those having Anglo-Saxon ethnicity—leading to differential reproductive success—and that the two groups were, to an extent, reproductively isolated. Although Pattison questions some of the assumptions of this model, the mainstay of his argument is that the proportion of indigenous British ancestry had been eroded since the pre-Roman period by a series of immigration events that are sufficient in magnitude to explain the genetic estimates of northwest continental European ancestry suggested by Weale *et al.* (2002; 50–100%) and Capelli *et al.* (2003; mean of 54%).

The methodology that Pattison (2008) uses is first to estimate the scale of various immigration and emigration events affecting Britain since the Late Iron Age and then to apply these figures to separate estimates of the size of the British population in order to generate a curve of the accumulated immigrant ancestry component over the last 2000 years. He assumes that the British population at the time of the Roman occupation already included approximately 5 per cent immigrant ancestry primarily due to an influx of people of Belgic descent (but see below). Broadly speaking, he infers an approximately 9 per cent immigrant ancestry component following Roman occupation, rising sharply to approximately 18 per cent following the Anglo-Saxon migration, then rising somewhat more gradually to approximately 23 per cent by 1750. After 1750, he infers a more dramatic rise in the immigrant ancestry component until by 1950 it reaches 36 per cent. Such inferences, while of interest, are highly speculative and based mostly on sparse data. But crucially, even if issues relating to the accuracy of Pattison's immigration episode estimates can be put aside (but see below), only a small fraction are relevant to the model explored by Thomas *et al.* (2006) or, more specifically, the Y-chromosome-based estimates of northwest European ancestry reported by Weale *et al.* (2002) and Capelli *et al.* (2003).

Both genetic studies estimate northwest continental European ancestry in England and both draw similar conclusions, but these studies are based on different approaches. Weale *et al.* (2002) observed a remarkable genetic similarity between five central English towns and a sample from Friesland while also finding striking differences between the English towns and two Welsh towns. They attempt to explain this similarity by conservatively assuming (i) genetic identity during the Neolithic and (ii) continuous gene flow between the ancestral English and Friesian populations since the Neolithic (set at 0.1% per generation). Using coalescent simulation, they conclude that such assumptions (individually or jointly) are insufficient to explain the observed genetic similarity, and that a mass migration event in the last 2425 years is required. Since the Anglo-Saxon migration is archaeologically and historically the best attested influx that affected England, but not Wales, in that period, they go on to estimate the scale of that migration (50–100%). Capelli *et al.* (2003) performed a number of analyses on a larger Y-chromosome dataset. In the one that is relevant for the discussion here, they estimate admixture proportions using a combined southern Danish/north German sample and a combined central Irish/Basque sample to represent the descendants of Anglo-Saxon and indigenous British populations, respectively. Although they found more regional heterogeneity—probably as a result of a wider sampling strategy—the mean southern Danish/north German contribution to the English gene pool was estimated to be 54 per cent. In both studies the source of migrants was specified, and in neither study—as wrongly implied by Pattison (2008)—did they assume genetic homogeneity in ancestral source populations. By contrast, Pattison provides an estimate of the total immigrant contribution to Britain—from any source population—since the Late Iron Age. While those originating in the source regions of the Anglo-Saxons (principally the northern Low Countries, northwest Germany and southern Denmark) are relevant to his argument and would go some way to explaining the results of Weale *et al.* (2002) and Capelli *et al.* (2003), any influx originating in genetically differentiated populations would only serve to increase the burden of explaining the observed similarity between England and northwest continental Europe. The only exception to this is migration that contributes equally to both England and the northwest continental European populations studied by Weale *et al.* (2002) and Capelli *et al.* (2003). Additionally, both genetic studies sampled only men whose respective paternal grandfathers were born within 30 km of their places of residence, in all cases small (population of less than 20 000) and long-established market towns. Such locations are less likely to be influenced by recent immigration than large cities

Received 19 May 2008
Accepted 1 July 2008

(Pooley & Turnbull 1996). We note that the most dramatic change in the proportion of indigenous British descent in Britain according to Pattison's model occurs after 1900 and is thus less likely to influence the results of the two genetic studies.

Pattison also appears to ignore the serious problems besetting estimates of relative and absolute numbers of natives and immigrants from historical and archaeological data. There are no recorded population figures for Britain before AD 1086 (Darby 1977; Holt 1987). For all earlier periods, population estimates are extrapolations from fragmentary evidence, and such estimates have varied considerably (Millett 1990; Härke 2002). Incidental reports of numbers of immigrants are notoriously unreliable, and absolute numbers of immigrants before the Norman period can only be calculated as a proportion of the estimated overall population. Pattison's procedure of estimating absolute numbers of migrants and then setting them in relation to the estimated absolute size of the overall population is, therefore, the wrong way round and likely to conflate error. Also, Pattison's model is deterministic, not stochastic. His forward accumulation approach would propagate any uncertainty poorly and, as is well known in population genetics (e.g. Ewens 2004), the variability of population processes tends to overwhelm the mean behaviour, which may be atypical. It would have been more appropriate to incorporate binomial sampling—as in the model presented by Thomas *et al.* (2006)—to quantify some of the uncertainties inherent in population dynamics. Without a sound probabilistic framework, we believe, there is no way of assessing the level of uncertainty in his results.

In addition to the methodological concerns above, we find a number of problems with the assumptions underlying Pattison's model. First, he overstates the case for a pre-Anglo-Saxon genetic influx from Germanic areas on the continent. His assumption of a Germanic descent of the Belgae and their migration into southern England in the pre-Roman period is based on an outdated hypothesis (Hawkes & Dunning 1930). The only evidence for their Germanic origin is the report by an outside observer, Caesar, who himself contradicts this claim elsewhere with a clear distinction between Belgae and Germani (von Petrikovits 1999). The ambiguous evidence for their migration to southern England has been debated for several decades (since Clark 1966; see Creighton 2000; Cunliffe 2005). The only safe conclusion can be that the Belgic migration (if any) would have added continental ancestry to southern England, not specifically Germanic ancestry. Concerning Germanic soldiers in Roman Britain, their proportion has been overstated in the literature (see Elton 1997). The exact numbers of Germani in the Roman army are not easy to estimate because recruitment was by regions, not by ethnicity (Mann 1983); and some of the figures suggested by Pattison rely, again, on the fallacious assumption that the inhabitants of Belgic Gaul were Germanic. And while there is widespread agreement today that not all Roman army units left the island in or by AD 407, the units that stayed behind were probably a few thousand frontier troops (limitanei), whose composition would have been mixed and added to by local recruitment (Holder 1982; James 1984). In consequence, any 'Germanic' genetic contribution into Britain before the Anglo-Saxon immigration is neither as certain, nor as substantial, as Pattison argues.

Second, Pattison's 'alternative' historical narrative of the Anglo-Saxon immigration is based almost entirely on a single book (Morris 1973) that was considered speculative and uncritical when it was published 35 years ago (see Dumville 1977). While one might expect that there was some cultural borrowing by the immigrants, virtually all examples quoted by Pattison are doubtful and disputed hypotheses (continuity of field boundaries; see Rippon 1991), unsupportable ideas (early tribute collection cannot be documented owing to the absence of written records before the seventh century; see Whitelock 1979) and withdrawn claims (continuity of Roman-style animal husbandry; see Crabtree 1993). Furthermore, on current evidence it is not possible to demonstrate the 'gradual blending' of British and Anglo-Saxon cultures suggested by Pattison, since in the fifth/sixth centuries AD the archaeological evidence in England shows only one culture, that of the Germanic immigrants, because that of the native Britons had become invisible even before the immigrants started to arrive in substantial numbers (Härke 2007). We note, however, that Pattison, notwithstanding a different perspective, agrees with our own estimate of the numbers of Anglo-Saxon immigrants.

Third, it is difficult to see how the author could have derived his reinterpretation of the late seventh century Laws of Ine from the original text. Britons are mentioned in several clauses; with one exception, they are mentioned as being in a subordinate role or of slave status; and in the one clause where 'free' Britons are mentioned, the monetary value of their lives (the wergild) is set at half that of their Saxon equivalents (Whitelock 1979). Even the testimony of a Briton in court is rated only half that of a Saxon witness. These provisions reflect a society systematically divided along ethnic lines; the historian Charles-Edwards (1995) has called it 'a polity of two nations', and a new sociolinguistic analysis by German (Thomas *et al.* 2008) fully supports this interpretation. While such ethnic and legal distinctions might 'encourage integration' (as Pattison claims), the laws themselves do not offer such a route: there are no provisions for Britons becoming Anglo-Saxons.

Fourth, in the case of our evidential argument from skeletal data, Pattison confuses starting assumptions and conclusions. The original argument did not 'assume' that burial with weapons was an almost exclusively Anglo-Saxon (i.e. immigrant) rite: it concluded that from a detailed analysis of all available skeletal and archaeological data of male burials with and without weapons in fifth- to seventh-century cemeteries, after alternative explanations of the skeletal differences between the two male groups had been discussed and dismissed. The full stature argument is contained in a German-language book (Härke 1992), which Pattison does not cite; he relied instead on the short summary in an English article (Härke 1990).

We accept Pattison's criticism of our use of the term 'intermarriage'. This term is somewhat euphemistic, and 'interbreeding' would have been more appropriate. However, we do mention that 'forced extra-marital matings are also likely to have occurred' (Thomas *et al.* 2006).

In summary, we find Pattison's (2008) argument, while persuasively written, to be wanting in terms of methodology, data sources, underlying assumptions and application. We conclude that for now an apartheid-like

social structure is supported by historical and archaeological evidence and remains the most plausible model to explain the high degree of northwest continental European male-line ancestry in England.

The authors wish to thank John Creighton (Reading), Simon James (Leicester) and Hella Eckardt (Reading) for information on the current state of the debate on pre-Roman and Roman populations in Britain.

Mark G. Thomas[1,*], Michael P. H. Stumpf[2] and Heinrich Härke[3]
[1]*Department of Genetics, Evolution and Environment, University College London, Wolfson House, 4 Stephenson Way, London NW1 2HE, UK*
[2]*Centre for Bioinformatics, Imperial College London, Wolfson Building, London SW7 2AZ, UK*
[3]*Department of Archaeology, The University of Reading, Whiteknights, Reading RG6 6AB, UK*
*Author for correspondence (m.thomas@ucl.ac.uk).

REFERENCES

Capelli, C. *et al.* 2003 A Y chromosome census of the British Isles. *Curr. Biol.* **13**, 979–984. (doi:10.1016/S0960-9822(03)00373-7)

Charles-Edwards, T. 1995 Language and society among the insular Celts, AD 400–1000. In *The Celtic world* (ed. M. J. Green), pp. 703–736. London, UK; New York, NY: Routledge.

Clark, J. G. D. 1966 The invasion hypothesis in British archaeology. *Antiquity* **40**, 172–189.

Crabtree, P. J. 1993 The economy of an Early Anglo-Saxon village: zooarchaeological research at West Stow. In *Case studies in European prehistory* (ed. P. I. Bogucki), pp. 287–307. Boca Raton, FL; London, UK: CRC Press.

Creighton, J. 2000 *Coins and power in Late Iron Age Britain. New studies in archaeology.* Cambridge, UK: Cambridge University Press.

Cunliffe, B. 2005 *Iron Age communities in Britain*. London, UK: Routledge.

Darby, H. C. 1977 *Domesday England. The Domesday geography of England*. Cambridge, UK; New York, NY: Cambridge University Press.

Dumville, D. N. 1977 Sub-Roman Britain: history and legend. *History* **62**, 173–192. (doi:10.1111/j.1468-229X.1977.tb02335.x)

Elton, H. 1997 *Warfare in Roman Europe, A.D. 350–425.* Oxford Classical Monographs. Oxford, UK: Clarendon Press.

Ewens, W. J. 2004 *Mathematical population genetics. Interdisciplinary applied mathematics*, vol. 27. New York, NY: Springer.

Härke, H. 1990 "Warrior Graves"? The background of the Anglo-Saxon weapon burial rite. *Past & Present* **126**, 22–43. (doi:10.1093/past/126.1.22)

Härke, H. 1992 *Angelsächsische Waffengräber des 5. bis 7. Jahrhunderts*. Cologne, Germany: Rheinland-Verlag; Bonn, Germany: Habelt.

Härke, H. 1998 Briten und Angelsachsen im nachrömischen England: Zum Nachweis der einheimischen Bevölkerung in den angelsächsischen Landnahmegebieten. *Studien zur Sachsenforschung* **11**, 87–119.

Härke, H. 2002 Kings and warriors: population and landscape from post-Roman to Norman Britain. In *The peopling of Britain: the shaping of a human landscape, the Linacre Lectures 1999* (eds P. Slack & R. Ward), pp. 145–175. Oxford, UK: Oxford University Press.

Härke, H. 2007 Invisible Britons, Gallo-Romans and Russians: perspectives on culture change. In *Britons in Anglo-Saxon England* (ed. N. J. Higham), pp. 57–67. Woodbridge, UK: Boydell Press.

Hawkes, C. F. C. & Dunning, G. C. 1930 The Belgae of Gaul and Britain. *Archaeol. J.* **87**, 150–335.

Hills, C. 2003 *Origins of the English*. Duckworth debates in archaeology. London, UK: Duckworth.

Holder, P. A. 1982 *The Roman army in Britain.* Batsford studies in archaeology. London, UK: Batsford.

Holt, J. C. 1987 *Domesday studies: papers read at the novocentenary conference of the Royal Historical Society and the Institute of British Geographers, Winchester, 1986.* Woodbridge, UK: Boydell.

James, S. T. 1984 Britain and the Late Roman army. In *Military and civilian in Roman Britain* (eds T. Blagg & A. C. King), pp. 161–186. Oxford, UK: British Archaeological Reports.

Mann, J. C. 1983 *Legionary recruitment and veteran settlement during the Principate*. Occasional publications, no. 7. London, UK: Institute of Archaeology.

Millett, M. 1990 *The Romanization of Britain: an essay in archaeological interpretation*. New York, NY: Cambridge University Press.

Morris, J. 1973 *The age of Arthur: a history of the British Isles from 350 to 650*. London, UK: Weidenfeld and Nicolson.

Pattison, J. E. 2008 Is it necessary to assume an apartheid-like social structure in Early Anglo-Saxon England?. *Proc. R. Soc. B* **275**, 2423–2429. (doi:10.1098/rspb.2008.0352)

Pooley, C. G. & Turnbull, J. 1996 Migration trends in British rural areas from the 18th to the 20th centuries. *Int. J. Popul. Geogr.* **2**, 215–237. (doi:10.1002/(SICI)1099-1220(199609)2:3<215::AID-IJPG35>3.0.CO;2-N)

Rippon, S. 1991 Early planned landscapes in south-east Essex. *Essex Archaeol. Hist.* **22**, 46–60.

Thomas, M. G., Stumpf, M. P. H. & Härke, H. 2006 Evidence for an apartheid-like social structure in early Anglo-Saxon England. *Proc. R. Soc. B* **273**, 2651–2657. (doi:10.1098/rspb.2006.3627)

Thomas, M. G., Härke, H., German, G. & Stumpf, M. P. H. 2008 Social constraints on interethnic marriage/unions, differential reproductive success and the spread of 'Continental' Y chromosomes in early Anglo-Saxon England. In *Simulations, genetics and human prehistory* (eds S. Matsumura, P. Forster & C. Renfrew), pp. 59–68. Cambridge, UK: McDonald Institute for Archaeological Research.

von Petrikovits, H. 1999 Germani cisrhenani. In *Germanenprobleme in heutiger Sicht* (ed. H. Beck), pp. 88–106. Berlin, Germany; New York, NY: de Gruyter.

Weale, M. E., Weiss, D. A., Jager, R. F., Bradman, N. & Thomas, M. G. 2002 Y chromosome evidence for Anglo-Saxon mass migration. *Mol. Biol. Evol.* **19**, 1008–1021.

Whitelock, D. 1979 *English historical documents, c. 500–1042.* English historical documents, vol. 1. London, UK: Eyre Methuen.

Woolf, A. 2004 Apartheid and Genocide: legal theory and economic reality. In *Britons in Anglo-Saxon England, Manchester, UK.*

Woolf, A. 2007 Apartheid and economics in Anglo-Saxon England. In *The Britons in Anglo-Saxon England* (ed. N. J. Higham), pp. 115–129. Woodridge, UK: Boydell & Brewer.